

MAQUETTE 5.6 – The Challenger *User's Guide*

Rodolphe BUDA

`rodolphe.buda@ac-poitiers.fr`

*Academy of Poitiers*¹

*University of West Paris-Nanterre La Défense*²

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¹Lycée Bernard Palissy – 1, Rue de Gascogne – 17100 SAINTES, FRANCE

²GAMA Team – 200, Avenue de la République – 92000 NANTERRE, FRANCE

"*Economic policy, like any real activity, has to reckon with many aspects originating from very different realms of life, and hence certainly not only economic viewpoints: institutional, juridical, technical in the widest sense of the word, and psychological.*" – Jan Tinbergen, ***On the Theory of Economic Policy***, Amsterdam, Elsevier, 1952, p.74.

I – General Overview

In this section, we first present the general step and the goal we are looking for through the use of MAQUETTE 5.6 software, then we’ll present the tool more precisely.

a) Purpose of the Software

The “economic simulation” is a particular approach [2, 8, 5, 3, 1] which simultaneously allows the teacher to teach economics and the economic scientist to analyze and synthesize economic mechanisms.

MAQUETTE 5.6 is a simple pedagogic tool, without any scientific purpose, intended for making aware the user¹, of the economic interdependence mechanisms and the effectiveness of economic policies that Nicholas Kaldor [6] summarized with his famous “magic square”.

This tool is based on a simplified Keynesian model built of twelve equations. Nevertheless, the user has no computation to perform. The system asks him to modify the value of some coefficients of the equations, in order to test some economic policies. As soon as the values of the parameters (coefficients, exogenous variables) have been changed, the user runs the resolution process. The tool then displays not only the value of the main macroeconomic aggregates of the system (endogenous one) but also a quality index (based on the Gross Domestic Product, the Unemployment Rate, the Public Finance Balance, and the Foreign Trade Balance) of the effectiveness of the assessed economic policy. Such an index provides a guide to program economic policies.

In using MAQUETTE 5.6 it could be an opportunity to criticize economic policy, as it was defined by the “Father” of the macro-econometric modelling Jan Tinbergen [9, 10].

Especially, it could be an opportunity to highlight to the students, that the simulation results have to be carefully considered. Indeed, the tool first provides a mathematical solution before one can consider it as an economic one. So, one can lead the students toward the famous Lucas’ critique [7] – the equations describe the passed behavior of economic agents and they could be no more relevant facing some specific economic policies.

MAQUETTE is a quantitative tool, however, it must lead students to consider some qualitative aspects of economic policies, especially their realism.

b) Presentation of the Software

The previous release of the software MAQUETTE was already downloadable on the EconPapers website, in activating the following url :

<https://econpapers.repec.org/software/dgeqmrbcd/182.htm>

However the quality index was not available in the previous releases. The software can be used as single-user or as a network station and the administrator (the teacher) manages the program SCOMAQ for displaying the quality index of the various simultaneous users ; the administrator (the teacher) manage the program SCOMAQ displays the SCOMAQ was implemented in Free Pascal and can be run under Windows 7 and following OS while MAQUETTE was implemented in Turbo-Pascal and can be run directly under Windows XP but MAQUETTE can be run under Windows 7 and following OS only via the DOSBOX

¹We particularly recommend to apply this tool with the classes of Terminale and the senior technicians section.

software. The DOSBOX software allows to emulate programs which only run under Windows XP and no more under Windows 7 and following OS.

The DOSBOX software is freely available under GNU license, and downloadable on the website :

<https://sourceforge.net/projects/dosbox/files/dosbox/0.74-3/dosbox-0.74-3.tar.gz/download>

The MAQUETTE package is available as an archiv file, SCOMAQ.ZIP. The structure of the folder is the following :

| | |
|--------------------------|-------------------------------|
| Desktop/ | |
| ├─ DAT/..... | DosBox Configuration Folder |
| ├─ PRG/..... | MAQUETTE Program Folder |
| │ ├─ DOSBOX.EXE..... | MAQUETTE Program Run File |
| │ ├─ MAQUETTE.CFG..... | Equations Parameters File |
| │ ├─ MAQUETTE.EQU..... | Model Equations File |
| │ ├─ MAQUETTE.EXE..... | Only Windows XP Runtime File |
| │ ├─ MAQUETTE.ICO..... | Icon |
| │ ├─ MAQUETTE.SCR..... | System File |
| │ ├─ MAQUETTE.SYS..... | Interface Parameters File |
| │ ├─ SDL.DLL..... | DosBox DLL File |
| │ └─ SDL_net.DLL..... | DosBox DLL File |
| ├─ ADDRESS.DAT..... | User's Folder Address File |
| ├─ CMD.EXE..... | DOS command File |
| ├─ INSTMAQ.EXE..... | MAQUETTE Install File |
| ├─ MAQUETTE.CFG..... | Equations Parameters File |
| ├─ MAQUETTE.SYS..... | Interface Parameters File |
| ├─ NAME.DAT..... | User's Names File |
| ├─ PARAM.DAT..... | User's Path File |
| ├─ SCOMAQ.EXE..... | SCOMAQ Program Runtime File |
| ├─ SCOMAQ.O..... | Overlay's SCOMAQ Program File |
| └─ SCOR.DAT..... | MAQUETTE Program Scores File |

II – Installation of the Software

In this section, we'll describe the parametrization of the software then it's installation procedure.

a) Parametrization of the Software

The economic data of the software MAQUETTE 5.6 are already calibrated. The user can however change whole or some parameters of the MAQUETTE.CFG file, under the condition to choose some consistent data. The MAQUETTE.SYS file must be not changed. It remains consistent with all the releases of the software. The MAQUETTE.EQU file contains the equations used by the software. It must be not changed.

The users connexions are managed by the three files ADDRESS.DAT, PARAM.DAT, and NAME.DAT.

Let's assume one wishes to install the software in a network structured as follows:



le fichier ADDRESS.DAT devra être rempli comme suit :
the ADDRESS.DAT file will be completed as follows:

| |
|---------|
| Eleve01 |
| Eleve02 |
| Eleve03 |
| Eleve04 |
| Eleve05 |

and the PARAM.DAT file as follows:

| |
|-----------------------------------|
| R:\Ecole\BTS\Classe\ \MAQUETTE |
|-----------------------------------|

Finally one fills the NAME.DAT file as follows:

| | |
|-------|----------|
| NOM01 | Prénom01 |
| NOM02 | Prénom02 |
| NOM03 | Prénom03 |
| NOM04 | Prénom04 |
| NOM05 | Prénom05 |

These names are used for recording the simulations scores. The size of each record must be less or equal to 15 characters. Moreover, **Challenger** is the default alias of the system.

b) Installation Procedure

As soon as the parametrization is done, the user can run the installation. We recommend to instal the SCOMAQ folder on the desk whatever the kind of use (single user or network). When one runs INSTMAQ.EXE, it installs the software in all the user's folders and it automatically parametrizes the DOSBOX setup files of each user. INSTALL.EXE creates the SAVE.BAT file which allow to record the simulation results in the SAVE.DAT file stored inside the DAT folder.

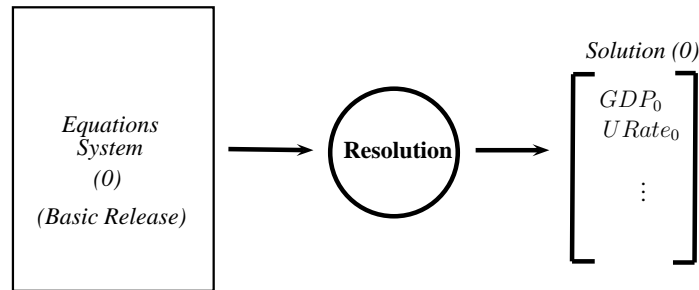
III – Single-User Mode to Use the Software MAQUETTE

In this section, we'll present the operating principle of the software then, we'll display some screenshots.

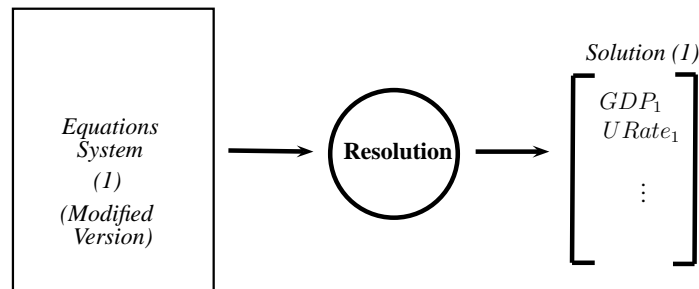
a) *Operating Principle of the Software*

As we've already wrote, the MAQUETTE software allows to perform economic simulations based on an equations system. The model is equations system keynesian-inspired. User is asked to change the equations' coefficients and then, the system computes automatically the solution.

During a first step, the software solves the system according to the initial parameters, it's the "central account":



During the second step, the software solves the system according to the new parameters chosen by the user:



During the third step, the user can observe, variable by variable, the difference between initial results and results after the parameters' change:

$$\begin{array}{c} \text{Gap} \\ \left[\begin{array}{c} \Delta GDP \\ \Delta URate \\ \vdots \end{array} \right] \end{array} = \begin{array}{c} \text{Solution 1} \\ \left[\begin{array}{c} GDP_1 \\ URate_1 \\ \vdots \end{array} \right] \end{array} - \begin{array}{c} \text{Solution 0} \\ \left[\begin{array}{c} GDP_0 \\ URate_0 \\ \vdots \end{array} \right] \end{array}$$

b) *Presentation of a Single User Mode Use Session*

The software provides some informations to the user in order to guide him during the choice of the new parameters. Obviously one can change only the coefficients and the exogeneous variables and not the variables endogeneous one which are computed by the system during the simulations. In order to this purpose, the software displays repeatively the same screens to the user.

1) The user is asked to change one or many parameters of the equations' system.

Figure 1: Request to Change Parameters

2) The user select one or many parameters, that he wishes to change – the choice is automatically highlighted.

Figure 2: Choice and Consideration of Parameters

3) The software computes and displays the solution of the "central account".

| | | | |
|-----------------------|---------|----------------------|-----------|
| GDP | 1623.38 | INVESTMENT AMOUNT | 405.84 |
| CORPORATE TAX AMOUNT | 97.40 | IMPORT AMOUNT | 243.51 |
| BENEFITS OF FIRMS AND | 324.68 | EMPLOYMENT | 3.2E+0007 |
| DISCRETIONARY INCOME | 1038.96 | RATE OF UNEMPLOYMENT | -0.59 |
| INCOME TAX AMOUNT | 103.90 | TRADE BALANCE | -93.51 |
| CONSUMPTION AMOUNT | 831.17 | PUBLIC FINANCE BALAN | -148.70 |

Figure 3: "Central Account" Displaying

4) The software computes and displays the solution of the system after the parameters' change – *i.e.* the "Variant Account".

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|------------------------------|-----------|---------|-------------------|--------|----------------------|-------|---------------|--------|-----------------------|--------|------------|-----------|----------------------|---------|----------------------|-------|-------------------|--------|---------------|---------|--------------------|--------|----------------------|---------|
| Keynesian Demand Model | MAQUETTE Release 5.6, MMXX | Account Variante Level | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"><tr><td>GDP</td><td>1666.67</td><td>INVESTMENT AMOUNT</td><td>416.67</td></tr><tr><td>CORPORATE TAX AMOUNT</td><td>83.33</td><td>IMPORT AMOUNT</td><td>250.00</td></tr><tr><td>BENEFITS OF FIRMS AMO</td><td>333.33</td><td>EMPLOYMENT</td><td>3.3E+0007</td></tr><tr><td>DISCRETIONARY INCOME</td><td>1166.67</td><td>RATE OF UNEMPLOYMENT</td><td>-0.63</td></tr><tr><td>INCOME TAX AMOUNT</td><td>116.67</td><td>TRADE BALANCE</td><td>-100.00</td></tr><tr><td>CONSUMPTION AMOUNT</td><td>933.33</td><td>PUBLIC FINANCE BALAN</td><td>-150.00</td></tr></table> | | | GDP | 1666.67 | INVESTMENT AMOUNT | 416.67 | CORPORATE TAX AMOUNT | 83.33 | IMPORT AMOUNT | 250.00 | BENEFITS OF FIRMS AMO | 333.33 | EMPLOYMENT | 3.3E+0007 | DISCRETIONARY INCOME | 1166.67 | RATE OF UNEMPLOYMENT | -0.63 | INCOME TAX AMOUNT | 116.67 | TRADE BALANCE | -100.00 | CONSUMPTION AMOUNT | 933.33 | PUBLIC FINANCE BALAN | -150.00 |
| GDP | 1666.67 | INVESTMENT AMOUNT | 416.67 | | | | | | | | | | | | | | | | | | | | | | | |
| CORPORATE TAX AMOUNT | 83.33 | IMPORT AMOUNT | 250.00 | | | | | | | | | | | | | | | | | | | | | | | |
| BENEFITS OF FIRMS AMO | 333.33 | EMPLOYMENT | 3.3E+0007 | | | | | | | | | | | | | | | | | | | | | | | |
| DISCRETIONARY INCOME | 1166.67 | RATE OF UNEMPLOYMENT | -0.63 | | | | | | | | | | | | | | | | | | | | | | | |
| INCOME TAX AMOUNT | 116.67 | TRADE BALANCE | -100.00 | | | | | | | | | | | | | | | | | | | | | | | |
| CONSUMPTION AMOUNT | 933.33 | PUBLIC FINANCE BALAN | -150.00 | | | | | | | | | | | | | | | | | | | | | | | |
| Multipl. 3.333333 | Type <cr> R.Buda, GAMA-Université Paris 10 | Endo: 12 Exo : 10 | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 4: "Variant Account" Displaying

5) The software computes and displays, variable by variable, the gap and the quality index of the economic policy tested.

| | | |
|---|---|--------------------------------|
| Keynesian Demand Model | MAQUETTE Release 5.6, MMXX | Account Variante Gap |
| INDICE =0.4807 LESS THEN CENTRAL INDEX 0.4965 | | |
| GDP | 43.29 | INVESTMENT AMOUNT 10.82 |
| CORPORATE TAX AMOUNT | -14.07 | IMPORT AMOUNT 6.49 |
| BENEFITS OF FIRMS AMO | 8.66 | EMPLOYMENT 8.5E+0005 |
| DISCRETIONARY INCOME | 127.71 | RATE OF UNEMPLOYMENT -0.04 |
| INCOME TAX AMOUNT | 12.77 | TRADE BALANCE -6.49 |
| CONSUMPTION AMOUNT | 102.16 | PUBLIC FINANCE BALAN -1.30 |
| Type <cr> | | |
| Multipl. 3.333333 | R.Buda, GAMA-Université Paris 10 | Endo: 12 Exo : 10 |

Figure 5: "Gap Account" Displaying

6) The software displays the resolution schema.

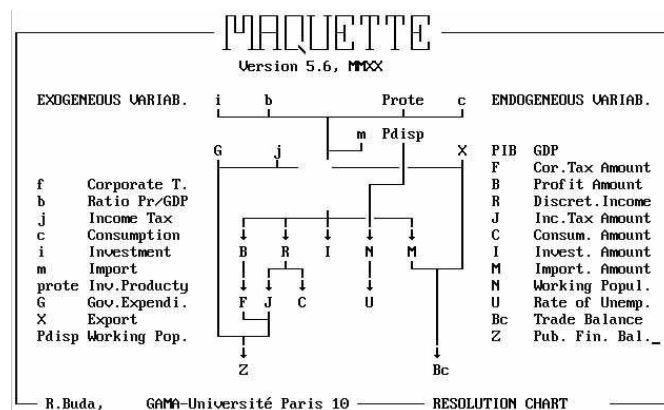


Figure 6: Resolution Schema Displaying

7) The computers displays the impact of the parameters' change to the "keynesian multiplier".

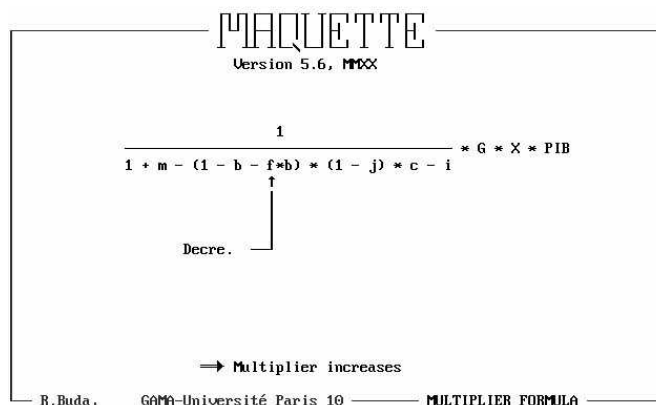


Figure 7: Displaying of the Impact on the Keynesian multiplier

8) The software displays the equations system thanks the key "?".

The screenshot shows the MAQUETTE Version 5.6, MEXX interface displaying a list of equations. The equations are numbered 1 through 13 and include the Multiplier formula.

| Variable | Equation |
|------------------------|--|
| Walras Identity | (1) $Q + M = C + I + X + G$ |
| Benefits | (2) $B = b \cdot Q$ |
| Investment | (3) $I = i \cdot Q$ |
| Import | (4) $M = m \cdot Q$ |
| Corporate Tax | (5) $F = f \cdot B$ |
| Income's share | (6) $R = Q - F - B$ |
| Income Tax | (7) $J = j \cdot R$ |
| Consumption | (8) $C = c \cdot R$ |
| Working Population | (9) $N = \text{prote} \cdot Q$ |
| Unemployment Rate | (10) $U = (PDISP - N) / PDISP$ |
| Public Finance Balance | (11) $Z = (F + J) - G$ |
| Trade Balance | (12) $Bc = X - M$ |
| Multiplier | (13) $\mu = \frac{1}{1 + m - (1 - b - f \cdot b) \cdot (1 - j) \cdot c - i}$ |

The footer includes 'R.Buda, GAMA-Université Paris 10' and 'EQUATIONS LIST'.

Figure 8: Equations System Displaying

The results of the simulations are stored in a text file MAQUETTE.OUT all along the working session.

IV – Presentation of a Network Mode Use Session

In this section, we'll present the communications between the MAQUETTE and SCOMAQ softwares.

a) MAQUETTE.EXE-SCOMAQ.EXE *Interaction*

The SCOMAQ et MAQUETTE software parallelly run. When the user runs a simulation, the results are stored in the MAQUETTE.OUT file inside his works' folder.

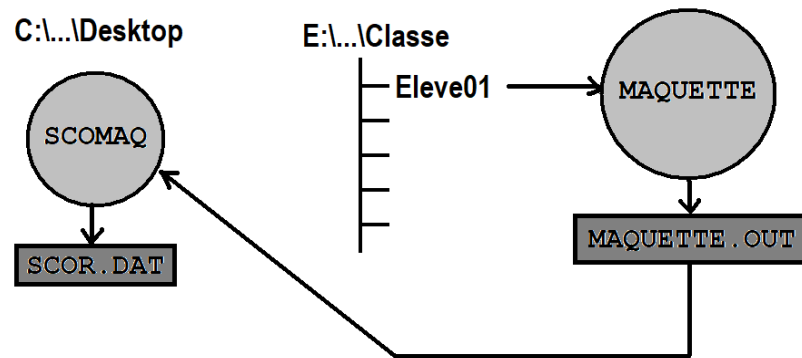


Figure 9: Communication Between MAQUETTE and SCOMAQ

The program SCOMAQ reads the results files of all users, sorts and displays on the administrator's computer, the users' indices in real time. The results are stored by the SCOMAQ software in the SCOR.DAT. The stored data are the dates, the user's names, and the value of all the parameters (coefficients and exogeneous variables) of the simulation.

| MAQUETTE SOFTWARE SIMULATIONS SCORES | | | | | | | | | | | | | |
|--------------------------------------|----------------|--------------------|----------|------|------|------|------|------|------|-------|-----|-----|----------|
| RANK | NAME | INDEX | DATE | f | b | j | c | i | m | prote | G | X | N |
| 1 | COMPTE CENTRAL | 0.4964820329967845 | 04.12.19 | 0.30 | 0.20 | 0.10 | 0.89 | 0.25 | 0.15 | 19600 | 350 | 150 | 20000000 |
| 2 | CHALLENGER | 0.4806709129521353 | 20.04.20 | 0.25 | 0.20 | 0.10 | 0.89 | 0.25 | 0.15 | 19600 | 350 | 150 | 20000000 |
| w1=0.4 w2=0.4 w3=0.1 w4=0.1 | | | | | | | | | | | | | |
| SCOMAQ 1.0 (c) MMXX | | | | | | | | | | | | | |

Figure 10: Real-Time Displaying of the Scores by SCOMAQ Software

b) *Presentation of a Network Working Session*

During a network working session, the administrator runs the SCOMAQ program on his computer while the users run MAQUETTE software² on their own computers. SCOMAQ program regularly reads the results files of the users in their MAQUETTE.OUT respective files, then it displays the new indices it has found. Now, we'll explain the process in an example.

²MAQUETTE.EXE under Windows XP and DOSBOX under Windows 7 and the following OS.

1) Our user is asked to type the simulation's parameters. The SCOMAQ program displays all the scores it found at this time³.

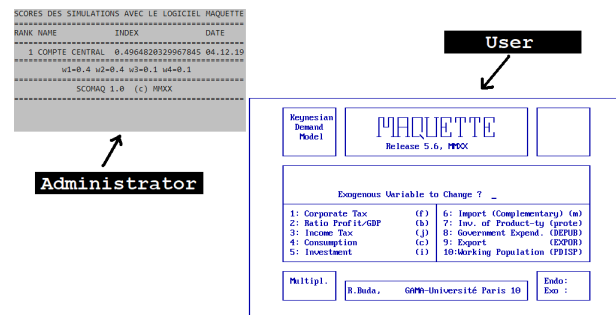


Figure 11: Interaction SCOMAQ-MAQUETTE before Input Parameters

2) During our user inputs the simulations parameters, SCOMAQ program displays all the scores it found at this time.

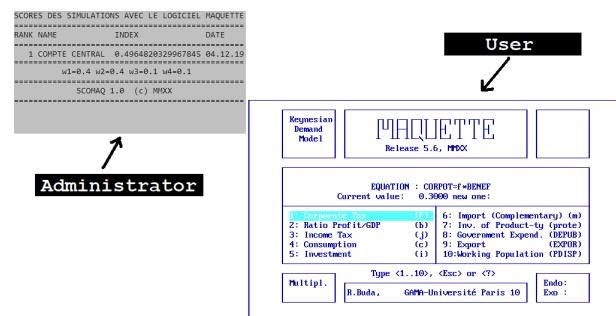


Figure 12: Interaction SCOMAQ-MAQUETTE during Input Parameters

2) After our user ran the MAQUETTE software, the SCOMAQ program displays all the scores it found, including the score of our user if it's good.

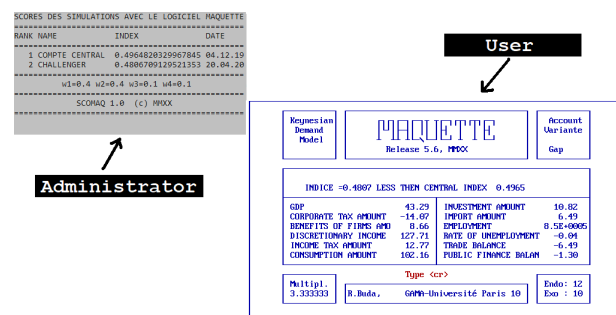


Figure 13: Interaction SCOMAQ-MAQUETTE after the Simulation

³One can resize the displaying in 80 columns in typing "SCOMAQ 80"

V – References

- [1] Augier P., Brillet J.L., Cette G. & Gambini R., "MacSim : un logiciel de simulation macroéconomique" *Economie internationale*, 2001, 85, pp.147–155.
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- [6] Kaldor N., "Conflicts in National Economic Objectives", *The Economic Journal*, 81, 1971, pp.1–16.
- [7] Lucas R.(1976). "Econometric Policy Evaluation: A Critique" in Brunner K. & Meltzer A. (Eds), *The Phillips Curve and Labor Markets*, Carnegie-Rochester Conference Series on Public Policy, . 1 New York, American Elsevier, 1976, pp.19–46.
- [8] Muet P.A., Bleuze E. & Giraud C., *Mic mac – la macro économie par la micro-informatique*, Paris, Economica, 1987, 191 p., + le logiciel MICMAC.
- [9] Tinbergen J., *On the Theory of Economic Policy*, Amsterdam, Elsevier, 1952, p.78.
- [10] Tinbergen J., *Economic Policy – Principles and Design*, Amsterdam, Elsevier, Coll. Contributions to Economic Analysis, 304 p.

VI – Appendices

a) The Equations of the System

$$Q + M = C + I + X + G \quad (1)$$

$$B = b.Q \quad (2)$$

$$I = i.Q \quad (3)$$

$$M = m.Q \quad (4)$$

$$F = f.B \quad (5)$$

$$R = Q - F - B \quad (6)$$

$$J = j.R \quad (7)$$

$$C = c.R \quad (8)$$

$$N = \text{prote}.Q \quad (9)$$

$$U = (PDISP - N)/PDISP \quad (10)$$

$$Z = (F + J) - G \quad (11)$$

$$Bc = X - M \quad (12)$$

Nomenclature

| | |
|-------|----------------------------|
| Q | GDP |
| B | Benefits |
| I | Investment |
| M | Importations |
| F | Corporate Taxes |
| R | Household Income |
| J | Income Taxes |
| C | Household Consumption |
| N | Employed Population |
| Prote | Labor Productivity Inverse |
| U | Rate of Unemployment |
| Z | Public Finance Balance |
| Bc | Foreign Trade Balance |
| X | Exportations |
| PDISP | Available Population |

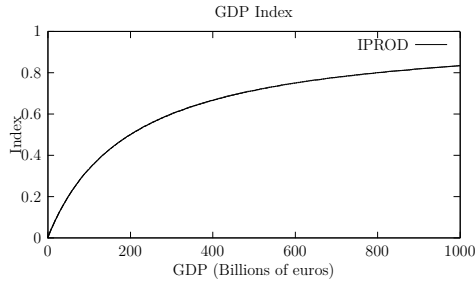
The lowercase denote the coefficients of the equations.

b) The Quality Index of the Economic policy

The quality index of economic policy is computed from the weighted average of some four other indices corresponding to the GDP, the Unemployment rate, the Public finance balance and the Foreign trade balance.

According to a normative point of view, the more is the GDP and the more is the balances (Public finance and Foreign trade), and the closer the unemployment rate is to zero, the better is the assessed policy.

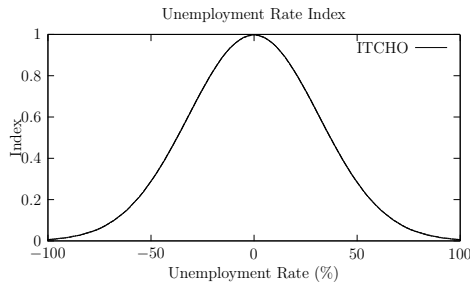
i) Quality Index of the GDP



The GDP Quality Index, \mathfrak{I}_{PROD} , varies between 0 et 1 according to the level of the GDP. It's computed according to the following formula:

$$\mathfrak{I}_{PROD} = 1 - \frac{1}{1 + 0.005 * PIB}$$

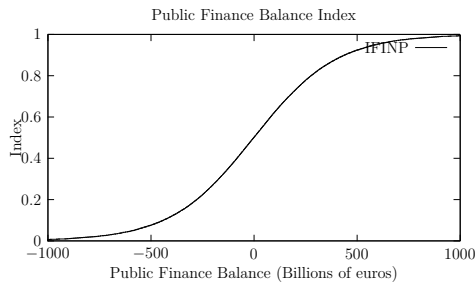
ii) The Quality Index of the Unemployment Rate



The Quality Index of the Unemployment Rate, \mathfrak{I}_{TCHO} , varies between 0 and 1 according to the percentage of the Unemployment. It's computed according to the following formula:

$$\mathfrak{I}_{TCHO} = \frac{2.5}{\sqrt{2 * \pi}} * e^{-5.0 * TCHO^2}$$

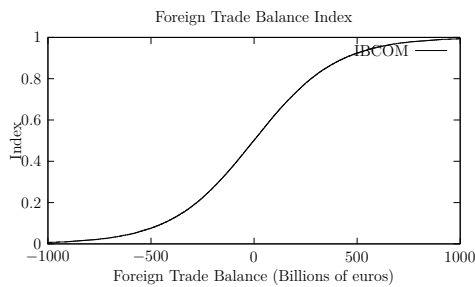
iii) The Quality Index of the Finance Public Balance



The Quality Index of the Finance Public Balance, \mathfrak{I}_{FINP} , varies between 0 and 1 according to the level of the balance. It's computed according to the following formula:

$$\mathfrak{I}_{FINP} = 1 - \frac{1}{1 + e^{0.005 * FINP}}$$

iv) The Quality Index of the Foreign Trade Balance



The Quality Index of the Foreign Trade Balance, \mathfrak{I}_{BCOM} , varies between 0 and 1 according to the level of the balance. It's computed according to the following formula:

$$\mathfrak{I}_{BCOM} = 1 - \frac{1}{1 + e^{0.005 * BCOM}}$$

v) General Quality Index

It's computed according to the following formula:

$$\mathfrak{I} = \omega_1 * \mathfrak{I}_{PROD} + \omega_2 * \mathfrak{I}_{TCHO} + \omega_3 * \mathfrak{I}_{FINP} + \omega_4 * \mathfrak{I}_{BCOM}$$

where ω_i denote the weights of each quality indices.